

REMARKS

Claim 1

Claim 1 is rejected under 35 U.S.C. 102(b), or alternatively under 103(a), as being anticipated/rendered obvious by Dolan, US Patent 4,566,170. Applicant respectfully traverses the rejection.

Claim 1 recites “the substrate is configured to have a thermal conductivity of at least 24 W/m·K.” Applicant has found no such teaching in Dolan.

Regarding a thermal conductivity of at least 24 W/m·K, the office action states “Though Dolan fails to explicitly teach that the substrate is configured to have a thermal conductivity of at least 24 W/mK, it is inherent that the substrate of Dolan has a thermal conductivity of at least 24 W/mK, because the materials of the substrate as disclosed by Dolan are the same materials claimed in the present application.”

Applicant respectfully submits that the thermal conductivity of a substrate including multiple layers is not inherent to the material, and depends on the configuration of the substrate. For example, if a substrate contains two highly thermally conductive layers separated by a thermally insulating layer, the overall thermal conductivity of the substrate will be low, despite the inclusion of highly thermally conductive materials. In the specific example of Dolan, Dolan’s ceramic member 12 and copper pallet 14 are separated by an epoxy of unspecified thermal conductivity, and whose thermal conductivity may vary based on how the epoxy is configured. Dolan does not provide enough information to estimate the thermal conductivity of the substrate, therefore claim 1 is not anticipated by Dolan.

The office action further states “If, assuming arguendo, Dolan cannot be viewed as disclosing/teaching a substrate having a thermal conductivity of at least 24 W/mK, it would have been obvious to one having ordinary skill in the art at the time the invention was made to configure the substrate to have a thermal conductivity of at least 24 W/mK in order to

optimize the substrate and dissipate a higher amount of heat from the LED through the substrate.”

Applicant respectfully submits that the office action has provided no expectation that Dolan can be successfully modified as proposed above. As described above, Dolan does not specify the thermal conductivity of the epoxy that connects copper pallet 14 to ceramic member 12. There is no expectation that an overall thermal conductivity of at least 24 W/m·K can be achieved for Dolan’s substrate, given the inclusion of the epoxy layer. Further, if the epoxy layer is omitted, it is unclear how the rejection proposes to connect copper pallet 14 to ceramic member 12, and achieve the claimed thermal conductivity. Finally, there is no motivation to modify Dolan to improve the thermal conductivity of the substrate, since the devices taught by Dolan are low power and do not generate a large amount of heat.

Dolan does not teach “the substrate is configured to have a thermal conductivity of at least 24 W/m·K” as recited in claim 1, and there is no expectation of success or motivation to modify Dolan as recited in the office action, therefore claim 1 is allowable over Dolan.

Claim 4

Claim 4 is rejected under 35 U.S.C. 102(b), or alternatively under 103(a), as being anticipated/rendered obvious by Dolan, US Patent 4,566,170. Applicant respectfully traverses the rejection. Claim 4 depends from claim 1, and is therefore allowable over Dolan for at least the same reason as claim 1.

In addition, claim 4 recites “at least one lead connected to the substrate.” The rejection states “Dolan further discloses/rendered obvious that at least one lead is connected to the substrate (*figure 1, 24; the lead is electrically connected to the substrate through device 18*).” Fig. 1 of Dolan clearly shows that anode leads 24 are connected to the semiconductor monolith. Accordingly, leads 24 are not connected to the substrate. Claim 4 is thus allowable over Dolan for this additional reason.

Claim 5

Claim 5 is rejected under 35 U.S.C. 102(b), or alternatively under 103(a), as being anticipated/rendered obvious by Dolan, US Patent 4,566,170. Applicant respectfully traverses the rejection. Claim 5 depends from claim 1, and is therefore allowable over Dolan for at least the same reason as claim 1.

In addition, claim 5 recites “at least one solder pad connected to the substrate.” The rejection states “Dolan discloses/rendered obvious at least one solder pad connected to the substrate (*figure 2, 20*).” Column 3 line 11 teaches that structure 20 is “silver epoxy,” not a solder pad. Further, even if silver epoxy can be used as a solder pad, neither of the structures connected to structure 20 (copper pallet 14 and semiconductor monolith 18) is solder, therefore Dolan is not using structure 20 as a solder pad. Claim 5 is thus allowable over Dolan for this additional reason.

Claim 6

Claim 6 is rejected under 35 U.S.C. 102(b), or alternatively under 103(a), as being anticipated/rendered obvious by Dolan, US Patent 4,566,170. Applicant respectfully traverses the rejection. Claim 6 depends from claim 1, and is therefore allowable over Dolan for at least the same reason as claim 1.

In addition, claim 6 recites “at least one terminated wire connected to the substrate.” The rejection states “Dolan further discloses/rendered obvious at least one terminated wire 24 connected to the substrate (*figure 1, 24*).” Fig. 1 clearly shows that anode leads 24 are connected to the semiconductor monolith. Accordingly, structure 24 is not connected to the substrate. In addition, Dolan’s structure 24 cannot be both claim 4’s “lead” and claim 6’s “terminated wire,” since the plain language of the claims indicates that these are different structures. Claim 6 is thus allowable over Dolan for this additional reason.

Claim 7

Claim 7 is rejected under 35 U.S.C. 102(b), or alternatively under 103(a), as being anticipated/rendered obvious by Dolan, US Patent 4,566,170. Applicant respectfully traverses the rejection. Claim 7 depends from claim 1, and is therefore allowable over Dolan for at least the same reason as claim.

Claim 7 recites “a bond disposed between the at least one copper layer and the core is a direct copper bond.” The rejection states “Dolan further discloses/rendered obvious that the bond between the at least one copper layer and the core is a direct copper bond (*figure 2, 14; 14 is made of copper so the bond between the substrate and the copper pallet contains copper*)”

Applicant respectfully notes that Dolan’s Fig. 2 shows an epoxy 16 between substrate 12 and copper pallet 14, therefore the copper pallet cannot be directly bonded to the substrate. Claim 7 is thus allowable over Dolan for this additional reason.

Claim 8

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dolan as applied to claim 1, in view of “Applicant’s Admitted Prior Art.” Applicant respectfully traverses the rejection. Claim 8 depends from claim 1, and is therefore allowable over AAPA and Dolan for at least the same reason claim 1 is allowable over Dolan.

Claim 8 recites “a bond disposed between the at least one copper layer and the core is an active metal braze.” The rejection states “Dolan fails to teach that the bond between the at least one copper layer and the core is an active metal braze. AAPA teaches the bond being an active metal braze . . . It would have been obvious . . . to combine the teachings of AAPA in the invention of Dolan because, in paragraph 0019, line 1, AAPA states this was known in the art.” Applicant respectfully notes that “this was known in the art” is not a motivation to combine. Claim 8 is thus allowable over Dolan and AAPA for this additional reason.

Claim 24

Claim 24 is rejected under 35 U.S.C. 102(b), or alternatively under 103(a), as being anticipated/rendered obvious by Dolan, US Patent 4,566,170. Applicant respectfully traverses the rejection. Claim 24 depends from claim 1, and is therefore allowable over Dolan for at least the same reason as claim 1.

Claim 24 recites “the at least one copper layer is in direct contact with the ceramic core.” The rejection states “Dolan further discloses/rendered obvious that the at least one copper layer is in direct contact with the ceramic core (*figure 2, 12, 14*).” Fig. 2 CLEARLY shows an **epoxy** 16 between ceramic substrate 12 and copper pallet 14, thus **there is no direct contact between the copper and the ceramic in Dolan’s device**. Claim 24 is thus allowable over Dolan for this additional reason.

Claim 25

Claim 25 is rejected under 35 U.S.C. 102(b), or alternatively under 103(a), as being anticipated/rendered obvious by Dolan, US Patent 4,566,170. Applicant respectfully traverses the rejection. Claim 25 depends from claim 1, and is therefore allowable over Dolan for at least the same reason as claim 1.

Claim 25 recites “the semiconductor light emitting device is configured to operate at a current density of at least 50 A/cm².” The rejection states “a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art is capable of performing the intended use, then it meets the claim.” Applicant respectfully submits that a person of skill in the art would appreciate that state-of-the-art light emitting devices at the time Dolan was filed generally operated at lower current densities than state of the art devices at the time the present application was filed. Dolan gives no indication

that Dolan's devices can be operated at the claimed current density. Claim 25 is therefore allowable over Dolan for this additional reason.

Claim 26

Claim 26 is rejected under 35 U.S.C. 102(b), or alternatively under 103(a), as being anticipated/rendered obvious by Dolan, US Patent 4,566,170. Applicant respectfully traverses the rejection. Claim 26 depends from claim 1, and is therefore allowable over Dolan for at least the same reason as claim 1.

Claim 26 recites "the semiconductor light emitting device is configured to operate at an electrical power consumption of at least 1 W." The rejection states "a recitation of the intended use of the claimed invention must result in a structural difference between the claimed invention and the prior art in order to patentably distinguish the claimed invention from the prior art. If the prior art is capable of performing the intended use, then it meets the claim." Applicants respectfully submit that a person of skill in the art would appreciate that state-of-the-art light emitting devices at the time Dolan was filed generally operated at lower power than state of the art devices at the time the present application was filed. For example, paragraph 6 of the present application teaches that historically, LEDs have operated at low power, for example, less than 300 mW. Dolan gives no indication that Dolan's devices can be operated at the claimed power consumption. Claim 26 is thus allowable over Dolan for this additional reason.

Other dependent claims

Claims 3, 10, 16, and 17 are rejected under 35 U.S.C. 102(b), or alternatively under 103(a), as being anticipated/rendered obvious by Dolan, US Patent 4,566,170. Applicant respectfully traverses the rejection. Claims 3, 14, 16, and 17 depend from claim 1, and are therefore allowable over Dolan for at least the same reason as claim 1.

Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Dolan as applied to claim 1, in view of “Applicant’s Admitted Prior Art.” Applicant respectfully traverses the rejection. Claim 2 depends from claim 1. The rejection’s analysis of “Applicant’s Admitted Prior Art” adds nothing to the deficiencies of Dolan with respect to claim 1. Therefore, claim 2 is allowable over Dolan and “Applicant’s Admitted Prior Art” for at least the same reason claim 1 is allowable over Dolan.

Claims 9 and 14 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dolan. Applicant respectfully traverses the rejection. Claims 9 and 14 depend from claim 1, and are therefore allowable over Dolan for at least the same reason as claim 1.

Claims 11-13 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Dolan as applied to claim 1, further in view of Whitworth et al., US Patent 6,642,550. Applicant respectfully traverses the rejection. Claims 11-13 and 15 depend from claim 1. The rejection’s analysis of these claims adds nothing to the deficiencies of Dolan with respect to claim 1. Claims 11-13 and 15 are therefore allowable over Dolan and Whitworth et al. for at least the same reason claim 1 is allowable over Dolan.

In view of the above arguments, Applicant respectfully requests allowance of all pending claims. Should the Examiner have any questions, the Examiner is invited to call the undersigned at (408) 382-0480.

Submitted Electronically

Respectfully submitted,

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